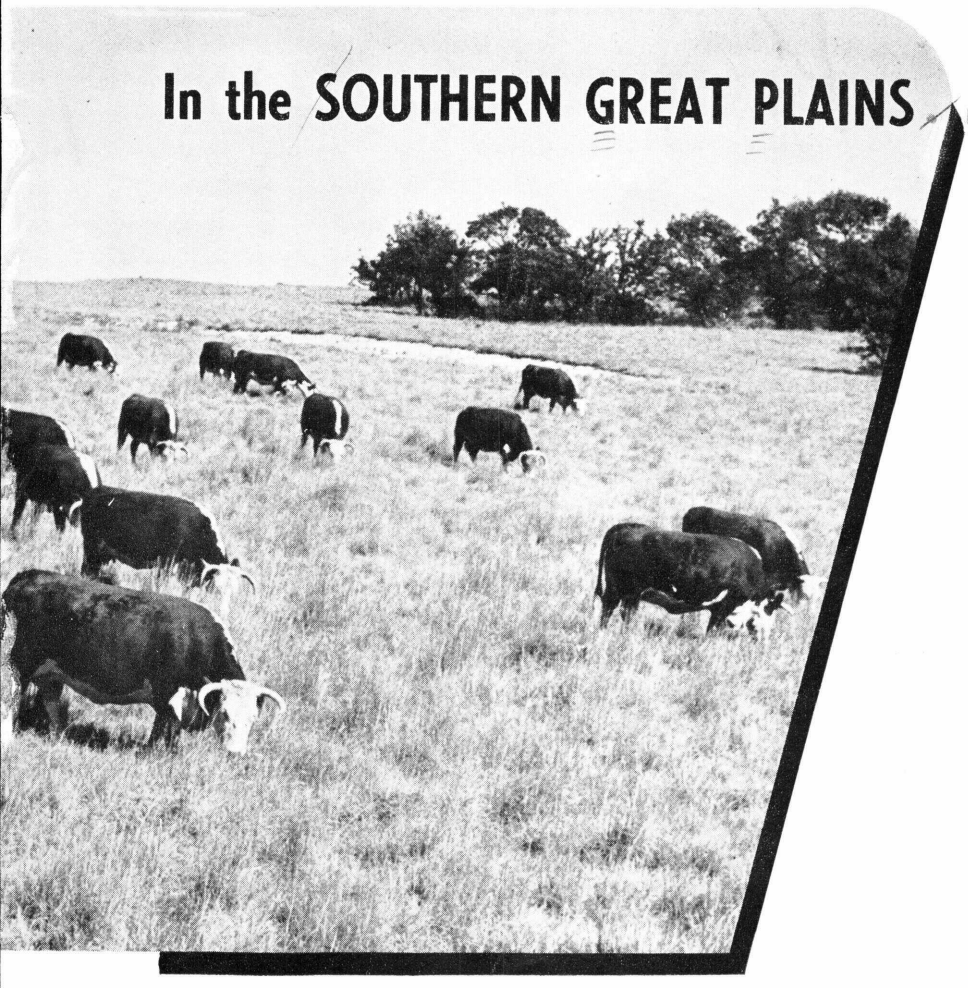
Grass FOR CONSERVATION

In the SOUTHERN GREAT PLAINS



Farmers' Bulletin No. 2093

UNITED STATES DEPARTMENT OF AGRICULTURE

GRASS is the most economical feed for livestock in the southern Great Plains. It also is the best means of protecting soil from wind and rain.

You can use grass in rotation on cropland to produce feed and to protect and improve your soil. You can seed land which is not suited to cultivation to permanent grasses. This bulletin tells what kinds of grass to use and how to seed them successfully.

Rangeland yields most when the grass is in top condition. You can improve most ranges by proper stocking, good grazing management, and special conservation practices to fit each range site and condition. Or you can restore native pastures ruined by drought and overuse by reseeding or by natural revegetation. Ranges brought to high condition will return you greater profits. They will also help prevent erosion and reduce floods.

The suggestions in this bulletin apply to the subhumid and semiarid plains of the western parts of Texas and Oklahoma, southwestern Kansas, southeastern Colorado, and eastern New Mexico.

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GRASS FOR CONSERVATION

in the Southern Great Plains

By B. W. Allred, *soil conservationist*, and W. M. Nixon, *agronomist, Soil Conservation Service*

Grass for livestock is the only crop that can be grown safely and continuously on about two-thirds of the southern Great Plains. Even on much of the land suitable for cultivation, there are many areas where the net return from grass will equal that from cultivated crops under normal conditions. When prices for livestock, hay, and seed are high, the return from grass frequently exceeds that from wheat, sorghum, or cotton.

Most of the ranches in the Great Plains depend entirely—or nearly so—on native grasslands for their forage supply. Farmers are turning more and more to a diversified agriculture, using grasses and legumes to feed livestock and to protect and improve soil. Grass is the number one crop of the southern Great Plains and the most important single factor in its economy.

Fortunately, the grasses best for grazing and livestock production are best also for soil and water conservation. To grow grass again on land now bare, and to improve and maintain existing grassland, are a primary concern of forward-looking ranchmen and farmers of this area.

The southern Great Plains cover about 117 million acres. Originally grass was everywhere. It produced abundant grazing for game animals and early-day livestock. But fire, the plow, excessive grazing, and drought have so damaged this cover that now much of the area needs revegetation.

This is generally a dry, hot land.

Cattle grazing a good stand of tall grasses on formerly cultivated land.

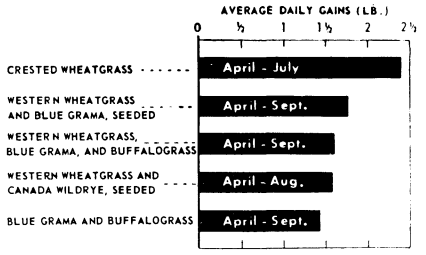
Range in Rolling Red Plains that needs to be planted to grass.

Abandoned cropland in the southern High Plains severely damaged by wind erosion.

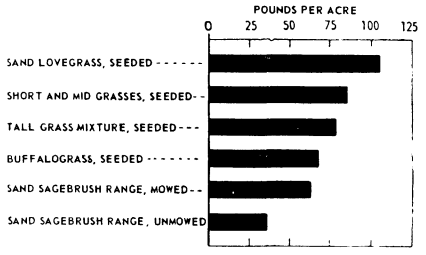
Strong winds are common. A continuous cover is needed to protect the soil from erosion.

Rainfall ranges from 35 inches in the east and northeast to 14 inches in the west and southwest. Rains are frequently hard and cause serious erosion on exposed land.

High temperatures and evaporation limit plant growth and make establishment of seedlings on bare ground difficult.



Steer gains from grass, 1943–49, on the Amarillo, Tex., conservation experiment station.



Four-year average annual steer gains from grass at the Southern Great Plains Field Station, Woodward, Okla.

WHERE TO USE GRASS

The hazards to agriculture are high throughout much of the southern Great Plains. To know which lands can be cultivated safely you need to have information, area by area, on the depth of the soil, its texture and water-holding capacity, steepness of slope, amount of erosion, and, of course, the climate. Land-capability classes have been developed to provide this information. If you are in a soil conservation district, you can obtain a map showing which land can be cultivated safely, which needs to be in grass part of the time, and which should be kept in a permanent cover.

More than 6 million acres now in cultivation in the southern Great Plains are not suitable for this use and should be seeded to perennial grass. Of those suitable for cultivation, nearly 25 million should have grass in the conservation cropping system. Much of the present grassland is in poor condition; 1,800,000 acres need to be overseeded with perennial grasses. In addition, 24,000 miles of waterways and 33,500 dams and spillways for ponds need to be seeded to a protective cover of grass.

GRASS FOR LIVESTOCK

Grass is the most economical feed for livestock in the southern Great Plains. About three-fourths of the feed eaten by domestic animals is unsuited for man to eat. Most of this is the grasses of ranges and pastures. Also included are grain straw and stover, byproducts of milling, and damaged grains.

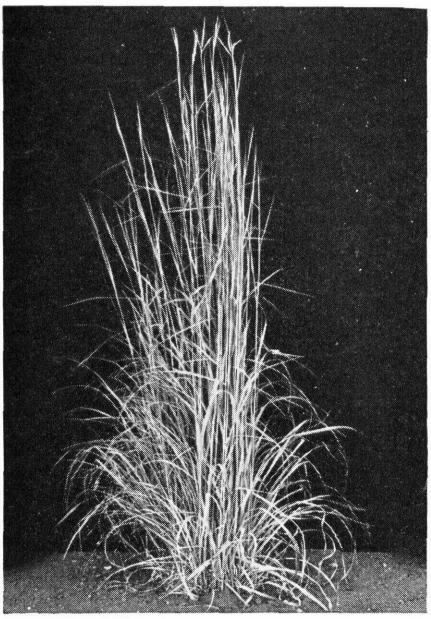
Livestock help maintain your soil fertility by returning about 80 percent of the plant food they eat to the land as manure. When you sell feed off your farm, however, all the plant food is removed.

Good weight gains on grass alone are made by livestock. At the Amarillo, Tex., conservation experiment station, average gains of steers on grass in summer ranged from 1.44 to 2.40 pounds per day. The differences were due to the different kinds of grasses grazed.

Gains per acre were highest on mid grasses and lowest on short grasses. Blue grama and buffalograss, both short grasses, were lower in protein and phosphorous than western wheatgrass or crested wheatgrass.

In 1947, a 44-acre crested wheatgrass pasture at Amarillo carried its usual quota of steers and still produced 303 pounds of seed per acre. Ungrazed crested wheatgrass produced 436 pounds of seed per acre,

BLUE GRAMA
Warm-season native perennial short grass
Adapted to sandy and hard lands
Grazed by all classes of livestock
High feeding value
Good soil-conserving plant
Fair seed producer



BIG BLUESTEM
Warm-season native perennial tall bunchgrass
Adapted to most sandy loam soils in southeastern Great Plains
Highly palatable as grazing or hay
High feeding value
Good soil- and moisture-conserving plant

and ungrazed western wheatgrass about 200 pounds per acre.

On the Dalhart land utilization project in Texas, seeded native grasses produced slightly greater steer gains per acre than fair or good native ranges. From April through October gains were about the same on native rangelands and adjacent seeded areas. After several years, yields of seeded areas and native ranges on similar range sites tended to become equal. Seeded ranges elsewhere show the same tendency, especially on the hard lands.

Seeded grasses also produced more beef per acre than grass from native ranges at the Southern Great Plains Field Station, Woodward, Okla. Highest yields were from sand lovegrass, which contains more protein than the other grasses planted.

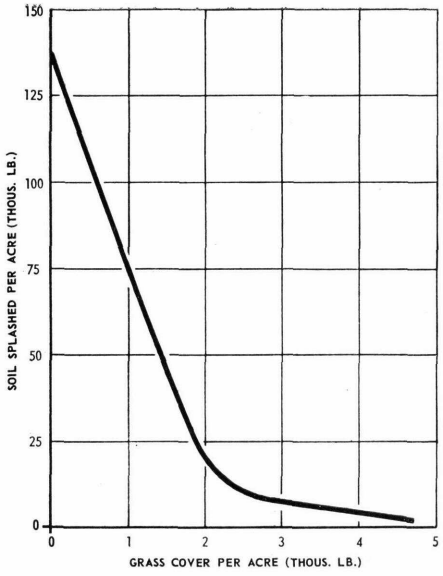
Many of the grasses, in addition to their grazing value, also produce good hay. The bluestems, Indian-grass, and switchgrass yield high-quality hay. In the higher rainfall belt, native hay yields are 1 to 2 tons per acre.

GRASS FOR CONSERVING SOIL

All conservation cropping systems include grasses or legumes, or both. These plants have many uses. They help to reduce erosion and leaching. They improve the structure of the soil, allowing water to sink in more readily. And they add organic matter and nitrogen to the soil. As a result, yields of other crops grown on the same land are higher.

Grass feeds and protects the soil as well as animals. Wherever too much is used for livestock and too little is left for the soil, erosion occurs and production declines.

On most rangeland, half—sometimes three-fourths—of the year's growth needs to be left to protect and feed the soil. Fortunately, this is the part of the grass crop least valuable for livestock. It consists largely of the coarse tufts and lower parts of the stems of the plants, which are least palatable and nutritious.



Amount of soil splashed per acre by the same rainfall with different amounts of grass cover.

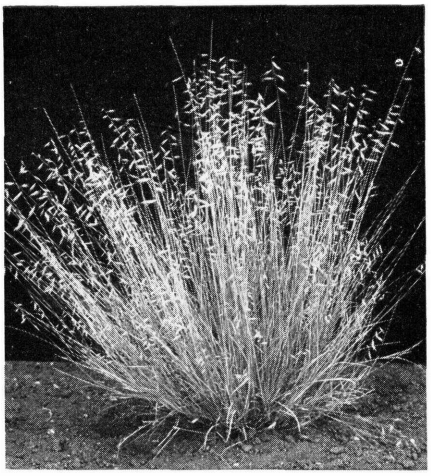
Protecting Soil

The leftover grass is not wasted. It keeps the soil safe from washing and blowing. It soaks up the rain when it falls and saves the moisture from evaporation. And leftover grass sustains the microscopic life in the soil which constantly renews the native fertility of the land.

A hard rain cannot drill through a tough coat of your old grass and splash soil loose to be carried off into gullies and streams. Such erosion takes place only where you have too much grass grazed off and leave the land unprotected.

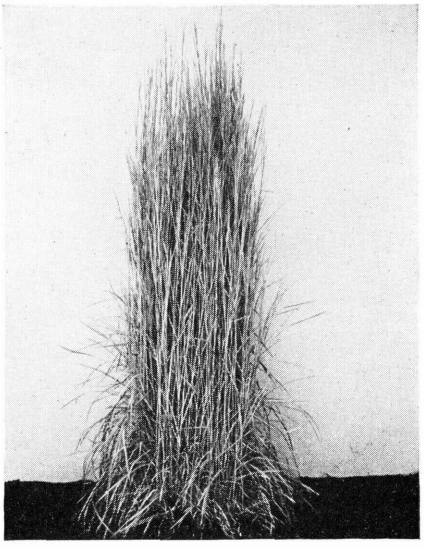
Tests at Amarillo, Tex., showed the effect of grass cover in preventing soil erosion. Rainfall that splashed 144,000 pounds of soil per acre on bare ground moved no soil at all where cover weighed 4 tons per acre.

This agrees with results of field tests on ranges throughout Texas and Oklahoma. Here 4,000 to 6,000 pounds of grass and litter per acre prevented any soil movement even in thunderstorms. But soil is exposed to serious erosion when the amount of cover is less than 2,000 to 3,000 pounds per acre.



SLENDER GRAMA

Warm-season native perennial fine-stemmed bunchgrass
Drought resistant
Adapted to southern part of Plains
High feeding value
Good soil- and moisture-conserving plant
Good seed producer



LITTLE BLUESTEM

Warm-season native perennial mid grass, fibrous root system
Good grazing and meadow plant
Good feeding value
Adapted to sandy soils on southern High Plains and to clay and sandy soils with high rainfall
Good soil- and moisture-conserving plant

BUFFALOGRASS

Warm-season native perennial short grass
Best adapted to heavy soils
Good forage plant
Provides good soil cover
Good seed producer

SAND BLUESTEM

Warm-season native perennial tall grass
Very well adapted to deep sandy soils
Good feeding value
Good soil-conserving plant

Tests at the Red Plains Soil Conservation Experiment Station near Guthrie, Okla., from 1930 to 1946 showed bermudagrass almost completely controlled soil erosion and reduced runoff. The average annual soil and water losses for the 17 years were as follows:

	Soil lost per acre (tons)	*Runoff water lost* (percent)
Bermudagrass	0.02	0.9
Bare hard fallow	16.8	26.0
Continuous cotton	28.6	27.8

In the western part of the southern High Plains, wind is a greater hazard to the soil than water. Grass is equally beneficial in protecting your land from wind erosion.

During the "dust bowl" days of the 1930's, and again in the 1950's, soil blowing occurred mainly on cropland and on rangeland that had little or no cover because of drought and continued grazing. Land with a good sod was safe, at least until covered with soil drifted from nearby exposed areas.

Wind-tunnel studies on the High Plains showed that most of the force of a high wind is intercepted by a good cover before it reaches the ground where it can move the soil grains. For example, 2,275 pounds of sorghum stubble reduced wind force by 90 percent just 1 inch above the ground. Range grasses would give the same protection.

Conserving Water

Grass helps hold the rain where it falls and uses every drop for increased production.

Grass litter, when it settles on the ground, provides an effective shield against the beating of the rain. Thus it prevents sealing of the soil surface and lets the water soak into your soil. Some of the rainwater filters through the subsoil into the water table where it accumulates to feed springs and streams.

Most of the little floods of the southern Great Plains can be stopped, and damages from the big ones reduced by

keeping defensive mats of grass on your ranges and pastures.

Much moisture is lost by evaporation. Your good grass cover helps cut down this loss. For example, the average annual rainfall on the Colorado River watershed in Texas is 27.9 inches. With ranges in fair and poor condition, about 70 percent, or 19.5 inches, of this moisture is lost by evaporation. Watershed studies show that this loss would be 10 percent less if the ranges were well covered with grass and litter.

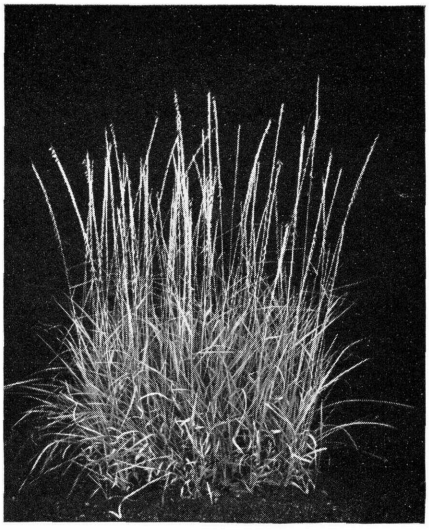
Grass cover has an insulating effect against the sun's rays. In summer, bare ground may be 25° to 50° F. hotter than under a good grass cover. As soil temperatures rise, evaporation increases. Above 115° F., activity of soil organisms stops, and plant growth is reduced.

Improving Soil

Grass litter finally disintegrates and becomes a part of the topsoil. As it decomposes into humus, it improves the tilth and fertility of your soil.

Another benefit from leftover grass is increased earthworm activity. Worm castings are numerous under dense litter and scarce under sparse cover. Worm tunnels loosen your compacted soil so that water can percolate freely. Air fills the holes and invigorates soil life. This subsurface cultivation by worms also stimulates root growth. The soil is enriched by plant fragments brought down and by minerals carried upward by worms. They frequently work as deep as 6 to 8 feet, reaching and bringing to the surface minerals beyond the active feeding zone of most grass roots. Part of their waste products (called castings) are deposited on the soil surface. Gradually, these castings merge into your topsoil, adding to it the soluble plant foods they contain.

For every pound of top growth, grass plants produce from 2 to 4 pounds of roots. Deep rooted grasses also tap deep sources of minerals. These plant foods are deposited in your topsoil with the decaying plant residue.



SIDE-OATS GRAMA

Warm-season native perennial mid grass
Adapted to most soils
Grazed readily by livestock
High feeding value
Good soil- and moisture-conserving grass
Good seed producer

INDIAN-GRASS

Warm-season native perennial tall grass
Adapted to sandy and sandy loam soils in higher rainfall part of the area
Excellent for grazing and hay
Excellent for soil and moisture conservation

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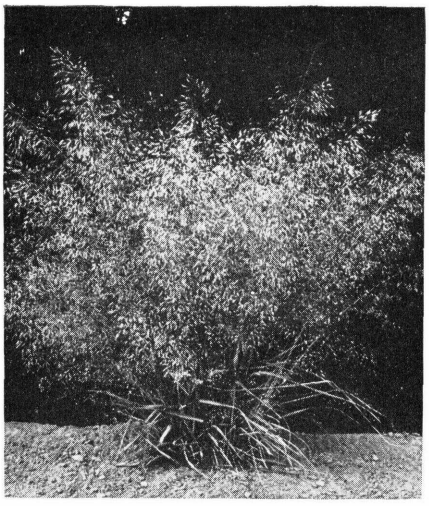
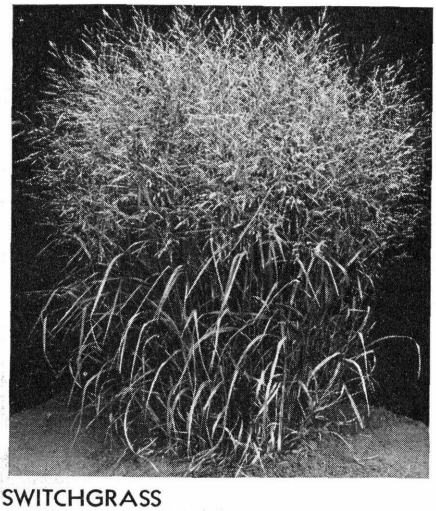


SAND LOVEGRASS

Warm-season native perennial mid grass bunchgrass growth
Adapted to sandy soils
High feeding value
Good soil-conserving plant
Good seed producer

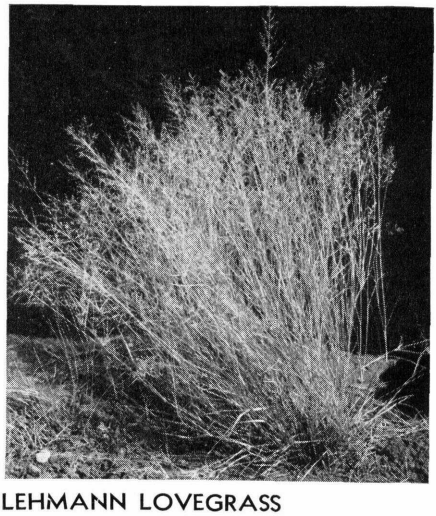
WEEPING LOVEGRASS

Introduced perennial warm-season bunchgrass
Adapted to sandy and sandy loam soils
Fair feeding value
Fair palatability
Very good seed producer
Excellent soil- and moisture-conserving plant



SWITCHGRASS

Warm-season native perennial tall grass
Adapted to sandy and sandy loam soils in dry areas and to most soils with high rainfall
Eaten readily by livestock when grazed or as hay
Good feeding value
Good soil- and moisture-conserving plant



LEHMANN LOVEGRASS

Warm-season introduced perennial fine-stemmed bunchgrass
Drought resistant
Adapted to southern part of Plains
Good feeding value
Fair palatability
Good seed producer
Very good soil- and moisture-conserving plant

Growing plants produce starches, sugars, cellulose, proteins, and fats. These products are added to the soil when the plant dies. The materials are used and reused, the growing plants getting part of their nourishment from the disintegrating parts of their ancestors.

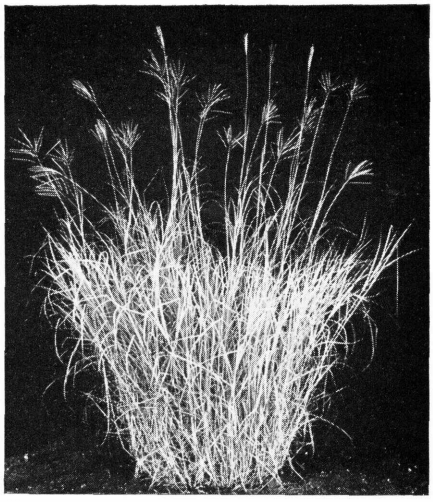
Grass roots penetrate deeply into soil. For example, at San Antonio, Tex., roots of King Ranch bluestem reached 10 to 15 feet into a tight heavy clay soil. This grass had twice as much vegetative growth below the surface as above.

Soils under native grass at the Blackland Experiment Station at Temple, Tex., contained 4.54 percent organic matter. After several years' cultivation to row crops the organic-matter content had dropped to 2.42 percent.

At the Ohio Experiment Station virgin sod weighed 65 pounds per cubic foot and had 60 percent pore space and 66 tons of organic matter per acre. The same soil after being cultivated for 40 years weighed 82 pounds per cubic foot and had 50 percent pore space and only 45 tons of organic matter per acre.

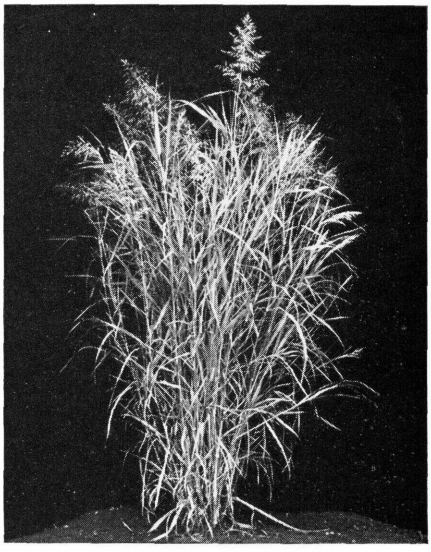
J. W. Thomas, a cooperator with the Salt Fork Soil Conservation District in west Texas, knows the value of grass for restoring organic matter and fertility to soil. He planted weeping lovegrass on deep blow sand that was producing about ½ bale of cotton per acre. He left the grass on the land for 2 years, using it for seed harvest. The third year he plowed the grass and planted cotton. Even though rainfall was below normal, the cotton yield was 1 bale per acre. The organic matter added by the grass increased fertility and moisture-storing capacity of the soil.

King Ranch bluestem, weeping lovegrass, blue panicum, Canada wildrye, and crested wheatgrass are some of the grasses well suited for use in your conservation cropping systems. You can readily establish all of them. They make rapid vigorous growth, resulting in quick economic returns in addition



KING RANCH BLUESTEM

Warm-season introduced perennial bunchgrass
Adapted to wide variety of soils and climate
Aggressive, spreads rapidly
Very palatable
Good feeding value
Excellent seed producer
Excellent soil- and moisture-conserving plant

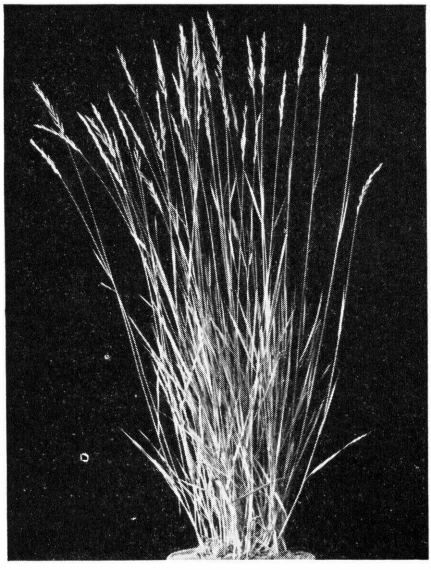


BLUE PANICUM

Introduced perennial warm-season bunchgrass
Adapted to sandy and heavy soils
Very palatable
High feeding value
Very good seed producer
Excellent soil- and moisture-conserving plant
Used for supplemental grazing in the warm season

CANADA WILDRYE

Cool-season native perennial bunchgrass
Adapted to sandy and sandy loam soils
Very palatable
High feeding value
Good seed producer
Good soil- and moisture-conserving plant



WESTERN WHEATGRASS

Cool-season native perennial mid grass
Adapted to heavy soils
Very palatable
High feeding value
Good seed producer
Excellent for soil and moisture conservation

to their soil-conserving and soil-improving value.

These grasses should be left in place for from 2 to 5 years and then alternated with other crops for from 2 to 3 years.

RESTORING GRASS COVER

Of the several million acres in the southern Great Plains which need seeding to establish a new grass cover, most is now cultivated, or has been recently. These fields require careful preparation for planting, and the new seedings need patient care to assure success. Experience of farmers and ranchers in the area, however, proves that both native and introduced grasses can be successfully reestablished.

Beside this cropland, large acreages of rangeland need reseeding. These include many areas made barren by drought and overgrazing. Others have a partial cover but are so lacking in good forage grasses that the seed must be planted to restore them within the near future. Special methods are needed to deal with these rangelands.

Most of the other rangelands can be improved by natural revegetation. Wise management of the native grasses already there usually is all that is needed. Brush control and other conservation practices often are helpful. These methods are described later.

Kinds of Grasses to Seed

The kinds of grasses you seed depend on your soil, other pastures available, and your needs.

All the grasses listed in table 1 can be successfully established in pure stands. Pure seedings are usually made for one of three specific purposes: supplementary grazing, seed production, or use in a conservation cropping system.

Mixtures are often used, especially in planting the warm-season grasses. Under most conditions mixtures give better stands than do single species. A mixture of seeded grasses also

provides a greater variety of forage.

The most common native warm-season grasses for seeding in the southern Great Plains are blue grama, side-oats grama, buffalograss, sand lovegrass, little bluestem, sand bluestem, big bluestem, switchgrass, and Indian-grass. Species of lesser importance are hairy grama, sand dropseed, and cane bluestem. Native cool-season grasses most in use are western wheatgrass, Canada wildrye, and Texas bluegrass. Texas wintergrass is a valuable cool-season grass in the southern part of the area. Usually you should seed Texas bluegrass and Texas wintergrass in pure stands. Western wheatgrass may be planted in pure stands for cool-season grazing or in combination with warm-season short grasses for yearlong pastures.

The most useful introduced warm-season grasses are weeping lovegrass, blue panicum, King Ranch bluestem, Caucasian bluestem, Boer lovegrass, and Lehmann lovegrass. Bermudagrass is extremely successful for use in waterways, or pond dams and spillways, and in bottom-land pastures.

Crested wheatgrass is the most common introduced cool-season grass. Others showing promise in parts of the

Harvesting King Ranch bluestem seed.

TEXAS BLUEGRASS

Cool-season native perennial sod-forming grass
Adapted to sandy and sandy loam soils
Very palatable
High feeding value
Fair seed producer
Very good soil- and moisture-conserving plant

CRESTED WHEATGRASS

Cool-season introduced perennial bunchgrass
Best adapted to heavy soils on High Plains
Very palatable for spring use
Feeding value is high
Good seed producer
Excellent soil- and moisture-conserving plant

area are intermediate wheatgrass and the tall fescues.

Seed Supplies

Seed supplies of native grasses, and of new introduced species, have been scarce. Until recently, most native grass seed was harvested from wild stands. Uncertainty of the supply and high cost of seed have limited plantings.

Seed of most desirable species, however, can be produced under cultivation. Growers have found this a profitable enterprise. Irrigation farmers, especially, find grass seed a promising cash crop. The following list of average yields per acre gives you some idea of the possibilities of grass-seed production under cultivation:

Grass	*Dryland (pounds)*	*Irrigation (pounds)*
Big bluestem	100–175	400–500
Caucasian bluestem	50– 75	150–200
King Ranch bluestem	50–100	200–250
Little bluestem	75–140	300–400
Sand bluestem	80–150	300–450
Buffalograss	50–100	300–600
Blue grama	100–150	500–600
Side-oats grama	200–250	500–800
Slender grama	75–125	250–300
Indian-grass	100–150	300–350
Boer lovegrass	75–150	400–500
Lehmann lovegrass	80–100	250–400
Sand lovegrass	80–140	400–500
Weeping lovegrass	60–100	400–600
Blue panicum	75–100	300–400
Sand paspalum	60–100	350–500
Switchgrass	75–100	500–600
Texas bluegrass	40– 60	200–300
Western wheatgrass	100–200	400–500
Canada wildrye	150–200	600–1,000

Soil conservation districts, aided by the Soil Conservation Service, have encouraged the production of needed grass seeds for local use.

SEEDING GRASS ON CROPLAND

Good land preparation, proper seeding methods, and careful protection of young stands are necessary for successful seeding of grass on cropland.

Some introduced grasses planted in rows and cultivated can be grazed the first season. Most native grass plantings require 2 years or more to become well enough established to be grazed or cut for hay.

Preparing the Land

Cropland subject to blowing or crusting needs a dead plant cover to protect young grass. Close-drilled sorghum is best for this purpose. The seedbed for the sorghum cover crop should be well prepared and clean. Drill or broadcast the sorghum as you would small grain. Cut or graze the crop so that a stubble of at least 10 to 12 inches is left in which to seed the grass. Under severe conditions leave the entire growth on the land.

On land not subject to serious blowing or crusting, sorghum planted in normal-width rows usually provides a satisfactory cover in which to seed. Cultivate the sorghum thoroughly to kill out as much weed competition for the grass as possible.

In the eastern part of the southern Great Plains where rainfall is greater and the land is not so subject to blowing, you can successfully seed grass on clean-tilled land. The seedbed should be thoroughly tilled and as firm as possible. Keep seeded areas free of weeds.

You can seed in some weed covers. Results are usually best on land that has been out of cultivation 2 or 3 years. Seedings are most likely to succeed in a cover of sunflower, pigweed, or Russian thistle. They usually fail in western ragweed, blueweed, horseweed fleabane, common ragweed, or silverleaf nightshade.

Disk land with a dense cover of threeawn grasses lightly. Set the disk straight to prevent destroying the plant residues. Fall or winter is usually the best time to seed such land. This allows seed to weather and seedlings to become established early and to better compete with the threeawn.

It usually takes 1 to 2 years longer to establish a good vigorous grass stand in competition with threeawn. Growing

a soil-conditioning crop, such as vetch or sweetclover, increases the soil productivity and results in more vigorous stands of grass.

How much seed you should use varies widely. It depends on seed quality, your soil, and your wishes. Because of high prices of some seeds, you may wish to plant less per acre and wait longer for the grass to develop. Or you may wish to use a high rate of seeding with the aim of using the grass sooner. Average recommended rates of seeding are in table 1.

These rates are for pure stands of a single species drilled or broadcast. Mixtures are usually seeded at a rate of 8 to 15 pounds per acre. Suggested proportions of different grasses to use in mixtures are in table 2.

For a full stand in the shortest time, the seeding rate should provide about 20 pure live seed per square foot. The rates recommended in table 1 will usually do this with seed of good commercial quality.

You can judge the quality of seed by the purity and germination percentages shown on the seed-test tag. Such a tag must be attached to every bag of seed sold commercially. If you are using locally grown seed, it is well to get a seed test. To find the percent of pure live seed, multiply the purity percentage by the germination percentage. From this information your soil conservationist or seed dealer can calculate the exact rate to give the desired stand from each lot of seed.

Seedings in 36- to 42-inch rows require about half the rates of drilled or broadcast plantings. Grasses usually seeded in rows are blue panicum, King Ranch bluestem, Caucasian bluestem, sand lovegrass, and weeping lovegrass. Buffalograss, the wheatgrasses, and Canada wildrye are either seeded in rows or drilled. Other grasses are usu-

Blue panicum used for summer grazing and as a soil-conserving and soil-improving grass in a conservation cropping system.

TABLE 1.—*Recommendations for seeding common grasses*

WARM-SEASON GRASSES

Grasses	Soil to which adapted	Seeding rate per acre	Period of seeding	Method of seeding	Depth of seeding
		Pounds			*Inches*
Bluestems:					
Big bluestem	Clay to sand	8 to 12	Jan. to Apr.	Grass drill or broadcast	½
Cane bluestem	Clay to loam	10 to 20	Mar. to May	Grass drill, row planter, or broadcast.	¼ to ½
Caucasian bluestem	Clay to loam	5 to 10	Mar. to May	Row planter or grass drill	¼ to ½
King Ranch bluestem	Clay to sand	5 to 10	Mar. to May	Grass drill, row planter, or broadcast.	¼ to ½
Little bluestem	Clay to sand	8 to 12	Jan. to Apr.	Grass drill or broadcast	½
Sand bluestem	Sandy clay to sand	8 to 12	Mar. to May	Grass drill	½
Buffalograss	Clay to loam	5 to 10, burrs 1 to 2, clean seed.	Feb. to May	Grass drill or row planter	½ to ¾
Sand dropseed	Loam to sand	2 to 4	Feb. to Apr.	Grass drill, row planter, or broadcast.	¼ to ½
Gramas:					
Blue grama	Clay to sandy loam	5 to 8	Mar. to May	Grass drill	½ to ¾
Hairy grama	Clay to loam	7 to 10	Feb. to Apr.	Grass drill	¼ to ½
Side-oats grama	Clay to sand	8 to 12	Jan. to Apr.	Grass drill	½ to ¾
Slender grama	Loam to sand	6 to 8	Mar. to May	Grass drill, row planter, or broadcast.	¼ to ¾
Indian-grass	Clay to sand	6 to 10	Jan. to Apr.	Grass drill or broadcast	½
Lovegrasses:					
Boer lovegrass	Clay to loam	½ to 1½	Feb. to Apr.	Grass drill, row planter, or broadcast.	¼ to ½
Lehmann lovegrass	Clay to sand	½ to 1	Apr. to Aug.	Grass drill, row planter, or broadcast.	¼ to ½
Sand lovegrass	Sand to sandy loam	1 to 2	Jan. to Mar.	Grass drill or broadcast	¼ to ½
Weeping lovegrass	Sand to sandy loam	1 to 1½	Mar. to May	Grass drill or row planter	¼ to ½
Blue panicum	Clay to sand	1 to 2	Apr. to June	Row planter or grass drill	0 to ½
Switchgrass	Clay to sand	4 to 8	Jan. to Apr.	Grass drill or broadcast	½

Texas bluegrass	Sand to loam	1½ to 2	Sept. and Oct.	Grass drill	½
Wheatgrasses:					
Crested wheatgrass	Clay to loam	8 to 12	Sept. and Oct.	Grain drill or grass drill	¾ to 1
Western wheatgrass	Clay to loam	10 to 12	Sept. and Oct.	Grain drill or grass drill	¾ to 1
Canada wildrye	Loam to sand	10 to 12	Sept. and Oct.	Grain drill or grass drill	½ to 1
Texas wintergrass	Clay to loam	10 to 15 (de-awned).	Sept. and Oct.	Grain drill or broadcast	½ to 1

NOTE: These seeding rates will provide about 20 pure live seed per square foot when drilled or broadcast in pure stands. Use about half the above rates for 36- to 42-inch rows.

TABLE 2.—*Recommended grass mixtures for different soils (percent of pure live seed in mixture)*

Area	Big bluestem	Little bluestem	Sand bluestem	Buffalograss	Blue grama	Sideoats grama	Slender grama	Indiangrass	Sand lovegrass	Switchgrass
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
High Plains:										
Deep clayey soils (hard lands)				20	50	30				
Shallow clayey soils (hard lands)				10	50	40				
Deep sandy soils		20	20			30		15	15	
Loamy soils (mixed lands)		15	10		25	35			15	
Rolling Red Plains:										
Deep clayey soils (hard lands)				20	50	30				
Loamy soils (mixed lands)		35	15		15	30				5
Sandy soils		20	20			20		15	15	10
Reddish Prairies	20	35				15		20		10
Cross Timbers	10	50				10		20		10
Grand Prairie	20	40				10		20		10
Edwards Plateau:										
Eastern half	5	45				35		15		
Western half					30	45	25			
Granitic soils	5	35				45		15		

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Combination grass drill developed by the Soil Conservation Service; seeds rough and clean seed and applies fertilizer in one operation.

ally drilled or broadcast, except when planted for seed production.

When To Seed

The usual practice is to seed warm-season grasses in the spring and cool-season grasses in the fall. Experience shows, however, that it is better to seed some of the warm-season native grasses in the winter. This is particularly true on areas where you cannot prepare good seedbeds. Table 1 shows the most favorable seeding dates for each kind of grass.

How To Seed

There are four common methods of seeding grasses in the southern Great Plains: (1) drilling in 1-foot rows with a grass drill; (2) planting in 36- to 42-inch rows with a picker-wheel type planter or with a special two-row grass planter; (3) broadcasting with various kinds of equipment, and (4) scattering seed-hay by hand or with a manure spreader. In addition, such grasses as crested wheatgrass and wildrye you can plant with a grain drill.

New equipment especially for seeding grass has been developed by several equipment companies. These grass drills plant both clean and trashy seed at desired rates. They plant at a uniform rate and depth, cover the seed, and firm the soil—all essential to getting a good stand. Drills with fertilizer attachments can be obtained.

With a grass drill you can plant the seed directly in heavy cover. This avoids exposing the land to erosion while the grass is becoming established and provides protection for the young plants. You can plant several species at the same time, resulting in stands similar to native ranges.

Planting in rows gives best results for seed production. Many farmers also like to plant quick-growing grasses like blue panicum in rows for supplemental grazing on cropland. This permits cultivating and fertilizing for extra production. You can make row plantings with the picker-wheel type cotton planter, or with a special grass-row seeder. A grass drill can be used by putting seed in only part of the boxes to get the desired row spacing.

When grass drills are not available or where the land is too rough for

Good sorghum cover ideal for seeding grasses.

A grass drill plants directly into a cover of sudangrass.

their use, broadcast the seed. The land needs to be disked to insure some coverage of the seed. Fertilizer distributors, cyclone seeders, grasshopper bait spreaders, and other broadcasting equipment can be used.

Tall native grasses can be established also by spreading grass hay cut after the seeds have matured. Broadcast the hay evenly by hand or with a manure spreader, using 1,500 to 2,000 pounds per acre. If the hay contains a heavy seed crop, you need less to get a stand but you should use additional straw covering.

The seed-hay method is well adapted to badly eroded and gullied areas. The hay material helps control erosion, holds down soil temperature, retards evaporation, and holds the seed in place.

Airplane seedings of little bluestem, big bluestem, Indian-grass, and switchgrass on prepared seedbeds look promising. Best results have been on a disked or plowed seedbed.

Care of Seeded Grasses

Young grass stands need protection from grazing until the plants are able to withstand trampling. This often takes 2 years for the native bluestems and gramas. Some grazing or seed harvest may be obtained the first year from King Ranch bluestem, weeping lovegrass, blue panicum, and the cool-season grasses.

Mow or otherwise control weed growth during the first growing season. Cultivate plantings in rows.

Do not plow up a seeding of native grasses as a failure until after the second growing season, regardless of how poor the stand appears. These grasses sometime germinate very slowly. The seedlings are very hard to recognize. Many times a planting which shows no promise the first year will develop into a good stand the second season.

Fertilizing Grasses

Nitrogen and phosphate fertilizers increase the vigor of seeded grasses where moisture is adequate for the additional growth. They are used most in areas receiving more than 22 inches average annual rainfall.

You should make first application at the beginning of the second growing season. Fertilizing at planting time increases weed growth before the

grasses are established. Best results are obtained from sidedressing row plantings whenever the plants show signs of needing nitrogen.

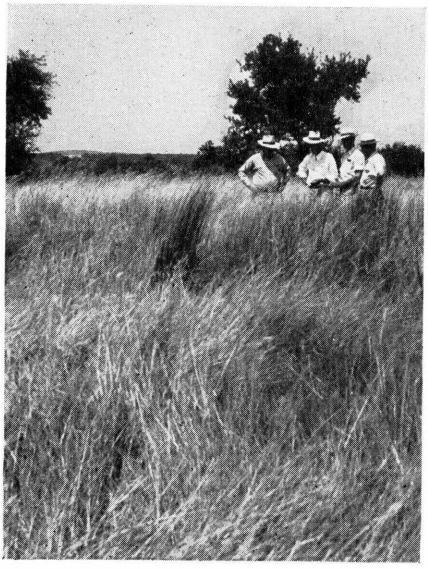
For seed production, apply fertilizer at the side of the rows when the grasses are 2 to 4 inches high.

SEEDING RANGELAND

In the southern Great Plains about 1,800,000 acres of grassland have too little good grass left for rapid natural recovery. These areas need to be planted.

Best results have been obtained in the higher rainfall areas. Elsewhere successful seedings have been made on overflow land and on subirrigated, gravelly, rocky, and sandy areas. In the low rainfall areas results have been poorest where soils are heavy or alkaline and where wind erosion is severe.

Seeded areas need protection from grazing until seedlings are well established. Livestock like to graze the young plants, and will destroy them if allowed to concentrate on them. At least one and sometimes two seasons are required to establish new grass stands.



Stand established from broadcasting King Ranch bluestem on rocky soils.

Harvesting native grass seed on rangeland.

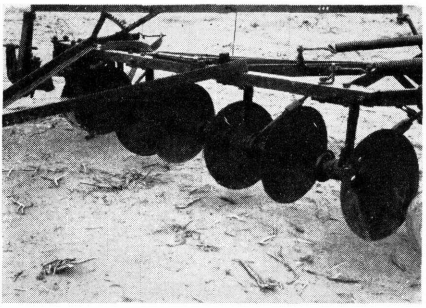
Seeding Methods

Broadcasting side-oats grama and King Ranch bluestem on rocky limestone ranges has resulted in satisfactory stands. Scattering of King Ranch bluestem seed-hay has given good stands on rocky ranges and on heavy soils. You can also establish this grass on short-grass ranges by seeding with a grass drill. Broadcast seeding followed by disking or direct drilling in light stands of sand sagebrush and shinnery oak has been successful in some areas.

As on cropland, airplane seedings on grassland are in the trial stage. Sand lovegrass seeded on the land utilization project near Dalhart, Tex., was reasonably successful. Lovegrasses and blue panicum have been seeded by airplane on sandy rangeland and where brush has been cleared by bulldozer or road plow.

Pitting to Prepare Seedbed

Pitting has been used to help establish grass on barren rangelands. Pitting is done with a disk plow having the disks set off center. This machine scoops out pits 3 to 4 feet long and several inches wide. The depressions catch rainwater and the loose soil helps to make a good seedbed for the grasses.



A disk plow with disks set off center for pitting rangeland.

Hard-land ranges that are barren and crusted are especially benefited by pitting. The disks cut through the surface crust and let rain soak into the soil. Grasses start readily in the pits.

You can do pitting on some mixed land or loamy soils, but do not do it on sandy ranges where the loose soil might be subject to wind erosion.

A grass drill can be pulled in tandem behind the pitting machine, or the pitted land can be seeded as a separate operation. Seeding should follow immediately after the pitting, before the soil is settled by rain.

NATURAL REVEGETATION

In the southern Great Plains about 78 million acres of rangeland probably have enough good grass left to make natural revegetation possible if they are well managed.

Whether or not your native grasslands can be improved without seeding depends mainly on their range condition. Range condition is graded by the kinds of grasses present as explained on page 22.

On ranges in excellent, good, or fair condition, and on some in poor condition, enough plants are present for natural revegetation. On these ranges, most new growth of the desirable grasses originates from rootstocks, tillers, and stolons. Mature, sod-forming Indian-grass, big bluestem, side-oats grama, and tobosa increase 2 to 6 inches outward from each side in a growing season. Especially active sod formers spread from 2 inches to 6 feet in a year. These include buffalograss, curlymesquite, vinemesquite, and western wheatgrass. Tillering grasses like blue grama, little bluestem, and Texas wintergrass grow outward ½ to 2 inches in a year.

Freshly pitted rangeland is a good seedbed for grasses.

On ranges in excellent condition natural seeding is far less important in stand improvement than the spreading of plants already established. Many seedlings sprout, live only a short time, and die of competition from the older plants. Often little bluestem, in climax stands, produces as many as 40 to 100 seedlings per square yard, but practically all die the first season.

On ranges below excellent condition, however, improvement through natural seeding is important. Under favorable conditions the following grasses produce numerous seedlings: little bluestem, silver bluestem, cane bluestem, New Mexico bluestem, threeawns, New Mexico feathergrass, needle-and-thread, sand dropseed, plains bristlegrass, hooded windmillgrass, sand paspalum, and fringeleaf paspalum.

Natural seeding is quicker on moderately grazed, summer-rested ranges than on heavily grazed or summer-grazed ones. In fact, heavily grazed ranges seldom reseed naturally. Natural seeding is best on rocky, sandy, gravelly and subirrigated land; it is poorest on hard land and on dry areas.

GRASS IN WATERWAYS

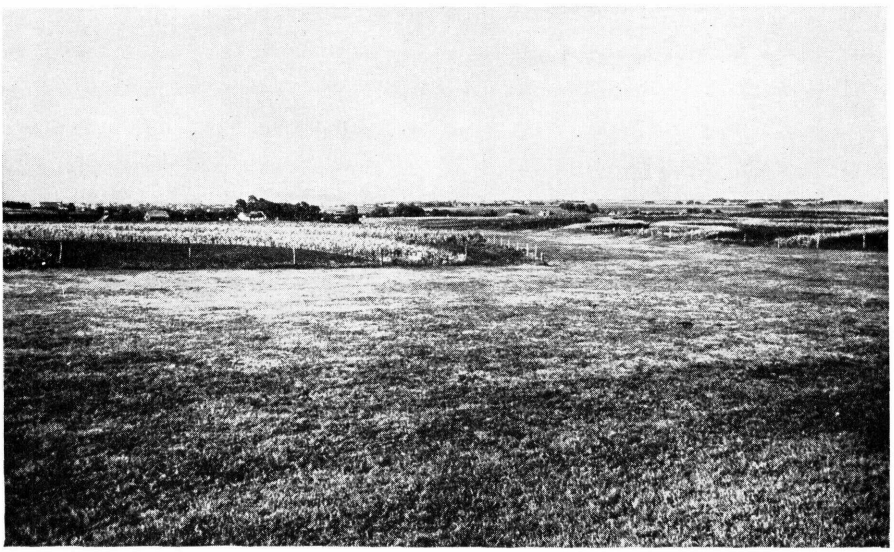
Grass waterways make safe disposal places for runoff. Many of them also provide an excellent source of grazing and hay.

Some of the best grasses for use in waterways are bermudagrass, western wheatgrass, King Ranch bluestem, and buffalograss. Intermediate wheatgrass can be used in the northern part of the area. You can use tall grasses such as Indian-grass, switchgrass, and the bluestems, but only in wide waterways. They take longer than the other grasses to become established.

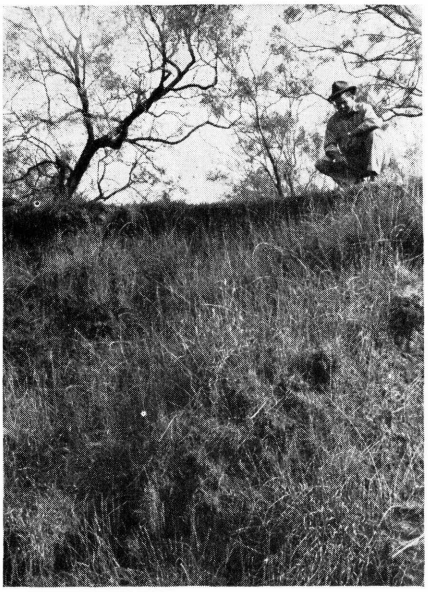
Use about twice as much seed for waterways as for field planting. Barnyard manure and nitrogen fertilizer worked into the soil before grass planting give a good cover more rapidly.

Bermudagrass is usually established by planting sprigs and the other grasses by seeding. You can broadcast or plant bermudagrass sprigs in rows 12 to 18 inches apart. Either way, cover the sprigs thoroughly. Firming the soil after planting usually results in a better stand of grass.

King Ranch bluestem can be estab-



This grass waterway is fenced and can be used for pasture or meadow. Terraces empty into each side of the waterway.



Gully stabilized with a good stand of grass.

lished in waterways by broadcasting seed-hay at a rate of 300 to 600 pounds per acre. If you cut the seed-hay into the soil with a disk or stalkcutter, it will not wash or blow away.

Where terraces or diversions are to empty into a waterway, let the grass get well started before you construct the terraces or diversions.

It usually takes about a year to establish a satisfactory grass cover in a waterway. During that time there should be no grazing, and weeds should be controlled by mowing or some other means. After the waterway has a good cover, grazing is the best way to keep it in good condition.

OTHER CONSERVATION USES

Grass has many other special uses in soil and water conservation. It is used to stabilize gullies; road and highway ditches and shoulders; ponds, dams, and spillways; drainage ditches; stripmined areas; gravel pits; airfields; and golf courses.

Seeding, sodding, and seed-hay mulching are all effective ways to establish grass on such areas. Where you have no topsoil, you need to add a protective cover. Cover seed with hay or straw or broadcast seed-hay. You may need to use barnyard manure or commercial fertilizer.

MANAGING GRASSLANDS

Once new grass is established, careful management is needed to keep it vigorous and productive. After the first 2 or 3 years, reseeded land can be managed as a part of the natural range.

However important it may be to restore grass cover to retired cropland and denuded ranges, there are even greater opportunities to increase forage production and conserve soil and water by proper management of natural grasslands.

Both reseeded and natural grasslands need management. The opportunities for improvement, and the management practices needed, depend upon the kind of rangeland and the condition of the vegetation.

A system of classifying rangeland by range sites, and grading the vegetation into range-condition classes, is in use in most soil conservation districts. Conservationists will assist you to check your soils and grasses and prepare a map of your land as a guide to proper management.

Classifying Rangeland

Rangelands are first classified into "range sites" of similar soils. A range site is an area that produces about the same kind and the same amount of vegetation when in its best condition.

The particular grasses that thrive best and occupy each range site in its top condition are known as "climax" grasses for that site. The different kinds of climax grasses help to identify the different range sites.

For example, the climax grasses on a sandy range site in the Oklahoma-Texas panhandles are bluestem and other similar tall grasses. A hard-land range

site nearby produces blue grama, buffalograss, and western wheatgrass as climax grasses. On the other hand, some range sites have similar kinds of climax grasses but vary in yield because of different soil-moisture or topographic conditions. On one ranch the 4-year average yield of climax grass on a valley range site was 3,216 pounds per acre and on an upland site 1,988 pounds per acre.

The vegetation on each range site is graded into four range-condition classes: Excellent, good, fair, and poor. A range site in excellent condition has 75 to 100 percent of its vegetation composed of original or climax grasses; in good condition it has 50 to 75 percent; in fair condition, 25 to 50 percent; and in poor condition, only 25 percent or less.

Improve Range Condition

Usually nothing can be done to improve a range site. The soil, rainfall, topography, and other factors that determine the range site are put there by Nature. You can, however, make sure of getting the greatest production possible from every range site by keeping it in the highest possible condition.

On similar range sites, total forage yield is usually highest on ranges in excellent condition and lowest on those in poor condition. Moreover, excellent-condition ranges provide more stubble and litter to protect and enrich the soil.

On three different range sites west of Fort Worth, Tex., yields roughly doubled when the range was improved from poor to excellent condition (table 3). Improvement in the quality of the forage was even more striking. On the upland range site, for example, the climax grasses made up 80 percent of the forage. Most of these were the high-producing little bluestem, sideoats grama, big bluestem, and Indiangrass. On the range in poor condition, these climax grasses made up only 20 percent of the ground cover but produced 46 percent of the forage. They had been partly replaced by buffalograss, annual broomweed, western ragweed, and other invaders.

Quality as well as amount of forage increased as range condition improved. Excellent- and good-condition ranges

TABLE 3—*Forage yields on various range sites and range conditions—Grand Prairie, Tex., midsummer, 1946–49*

Site	Range condition	Average forage yield per acre			
		Climax grasses	Climax forbs	Invaders	Total vegetation
		Pounds	*Pounds*	*Pounds*	*Pounds*
Valley site	Excellent	2,810	406	0	3,216
	Good	2,183	351	176	2,710
	Fair	1,720	244	344	2,308
	Poor	1,189	63	606	1,858
Upland site	Excellent	1,616	371	0	1,988
	Good	1,266	274	164	1,704
	Fair	969	171	299	1,439
	Poor	523	83	509	1,114
Ridge site	Excellent	1,193	200	0	1,393
	Good	906	158	138	1,201
	Fair	629	105	309	1,043
	Poor	346	43	339	729

produced more of the nutritious climax forbs or broad-leaved herbs than those in fair or poor condition. These plants included catclaw sensitivebriar, yellow neptunia, groundplum milkvetch, Indian paintbrush, heath aster, and about 20 native legumes. Although their yield is less, their protein content is 20 to 40 percent higher than grass forage. Also, some are spring growers, some summer, and some fall. Others, like the Englemanndaisy, form nutritious rosettes for winter grazing.

The total amount of protein in the edible forage produced by four condition classes also increased from poor to excellent. Although the percentages were about the same—6.0 percent for poor condition and 6.5 percent for excellent—total weights were quite different. For example, the upland range produced 67 pounds of protein per acre in poor condition, 90 pounds in fair, 110 pounds in good, and 129 pounds in excellent condition.

These differences show up in the land, in the plants, and in the livestock as ranges improve. The condition of each range is wholly under the operator's control; his management determines what kind, and how much, forage his land produces.

Adjust Grazing to Growth of Plants

Animals eat first the plants they like best. Usually these are the most nourishing. With continued overuse, these plants weaken and die. Then the animals turn to the next most palatable. The plants that survive heavy grazing are usually the least palatable, and often the least productive.

Grazing management must allow for each stage in the growth of plants. Otherwise you cannot expect maximum forage yield and peak animal production. These stages take place in this order: leaf development, root growth, flower-stalk formation, seed production, forage regrowth, and food storage in the roots.

The first growth a grass plant makes in the spring comes from food stored in its roots the fall before. This stored food may produce as much as 10 to 12 percent of the year's growth in height.

Once the plant has exhausted the food from its root reserves, it depends on its leaves for nutrients. For this reason, enough leaves must remain to manufacture food all during the growing season.

Rest at the beginning of the growing season helps to stimulate vigorous growth. If this is not possible, occasional rests through rotating pastures help.

Seasonal changes in forage greatly affect grazing. Animals range over the grazing grounds, selecting the most succulent and nutritious plants. Where they have a choice, they shift from maturing plants to tender young ones, which are higher in proteins, minerals, and vitamins. But in winter the better grasses and other herbs are dormant. Then livestock often try to satisfy their hunger for green forage by eating bitterweed, loco, or other poisonous winter-growing plants that are common on some rundown ranges.

Fortunately, the various good quality range plants reach their maximum usefulness at different times during the year. A good ratio between cool-season and warm-season grazing plants assures the greatest production of livestock with the least range abuse.

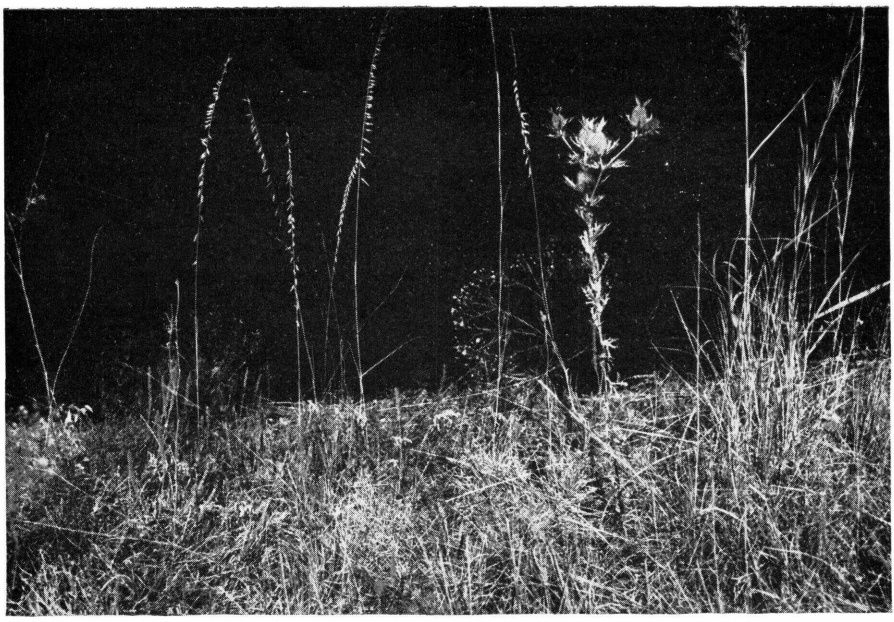
Animals make greatest gains on green forage. Usually they lose weight in winter. With foresight in planting, your abandoned farmland can help provide cool-season grasses for grazing in the winter.

At the southern Great Plains Field Station, Woodward, Okla., cattle were summered on native warm-season grasses and wintered on planted western wheatgrass and Texas bluegrass. These cattle made as much as 45 pounds more gain per year than cattle run yearlong on native warm-season grasses.

The Amarillo, Tex., conservation experiment station produced 1-000-pound steers in 20 to 22 months on

Excellent-condition range in the Grand Prairie. Little bluestem (center) makes up most of the cover. Side-oats grama (left) is in small amounts. There is some thrifty Indian-grass (right). These native grasses are the best that grow on the Grand Prairie.

Good-condition range in the Grand Prairie. Although still important, little bluestem is less abundant. Side-oats grama is equal to or more plentiful than the bluestem. Indian-grass and big bluestem are plentiful. Weeds like annual broomweed and Leavenworth eryngo and perennials like western ragweed, are present.



Fair-condition range in the Grand Prairie. Bluestem and Indian-grass are present but side-oats grama, silver bluestem, Texas wintergrass, and purple threeawn are most prominent. Annuals and weedy perennials are numerous.

Poor-condition range. Only small amounts of the climax grasses remain. Annuals like snow-on-the-mountain, broomweed (background), purple threeawn, evax, and hairy tridens make up most of the cover. These are all poor forage and soil-conserving plants. Given light use, this poor-condition range can improve and become excellent again.

grass and winter wheat. Only a small amount of cane bundles and commercial protein were fed the steers. Wheat pasture in the winter, crested and western wheatgrass in the spring, and blue grama and buffalograss in the summer and early fall provided year-round grazing. Steers of the same age carried through on native grass alone weighed 250 to 300 pounds less.

Grass is nearest perfection in early growth. Bluestem grasses pass their peak in both quality and yield by August. Bluestem near Fort Worth in 1946 made 8 percent of its year's growth in March and April, 23 percent in May, 32 percent in June, 23 percent in July, 9.8 percent in August, and 4.2 percent in September and October.

Some of the leaves of mid and tall grasses produced in early spring wither and drop to the ground by summer. Over 4 years at Cheyenne, Okla., steers on mowed pasture gained 82 percent of their total weight by July 15. Some years steers held on the range a month longer lost from 10 to 30 pounds. Ranchmen lost from $2 to $6 per head as a result of holding the steers too long after grass matured.

Use the Grass Moderately

A few general rules will help you decide when to use your range. Usually about half the yearly growth can be removed without injuring the grass. Sometimes in dry years or on poor-condition ranges, one-fourth may be all that can be safely grazed. At any rate, be sure to leave enough cover to catch the rainfall and protect the soil from erosion. This means that on the average short grasses should be left about 1½ to 2 inches high, mid grasses 4 to 7 inches, and tall grasses 7 to 10 inches.

Ranges where the better grasses are thriving will have several other signs of improvement. Plant vigor and forage yield will be high, litter will accumulate, nutritious forbs will be increasing, weedy forbs and undesirable grasses will be less evident, soil tilth will be better, and erosion and runoff will be less.

There are definite economic reasons for grazing your grass right. On the Spur, Tex., experiment station, yearly income from steers was 50 to 60 percent greater where they grazed only half the forage instead of three-fourths.

Successful managers use several safeguards to maintain ranges under fluctuating moisture conditions. One is to adjust the number of livestock to the amount of forage. Another is to shift animals to fresh grazing grounds or feed lots or to market before the plants are seriously hurt and valuable gains lost. Speediest shifts can be made by those who run stocker and feeder livestock. These animals are readily moved and sold.

If you have a breeding herd, you can reduce your risks by keeping 50 to 60 percent of your herd as breeding animals and 40 to 50 percent as stocker and feeder animals. Then during drought and other times of feed shortages, you can sell the stocker and feeder animals and leave all the forage to carry the breeding herd.

Even so, during droughts some reduction in livestock numbers may be necessary. Also, some superior plants may die. But enough usually remain to restock the range with their kind. Where drought accompanies heavy grazing, most—sometimes all—superior grasses may be killed.

Distribute Grazing Uniformly

You may find it hard to graze uniformly where range sites and range conditions vary or where watering places are widely separated. Livestock generally prefer to graze flatlands; they leave steep, broken, or rocky areas to the last. In fact, they often trail up a steep hill covered with excellent forage to graze poorer forage on a mesa or tableland.

Most domestic animals avoid wet, muddy, or boggy places except when forced to them by feed shortages or insects elsewhere. In wet weather they prefer sandy soil to gumbo and heavy

clay. They like to graze in soft soil that is free of rocks and gravel. Sheep graze steep slopes better than cattle, and goats better than sheep.

A ranch needs enough well-spaced watering places to encourage the animals to spread out. This helps avoid local overuse of forage. You need to exercise especial care in spacing watering places where there are different range sites or where the land is rough.

For example, on a 1,690-acre ranch at Marfa, Tex., the only water was at the extreme north end. Grass was overused in a 2-mile-long valley that led to water. Range condition near the water was poor, in the valley it was fair, on adjacent rolling upland it was good, and on an inaccessible tableland it was excellent. Water was piped to the tableland and several good trails were built to make the distant and rough land easier to graze. More equal use of the forage resulted.

You can use grazing animals' need for salt to get more uniform use of your range. By locating salt stations at the right places you can entice livestock to areas they would otherwise graze lightly. You can also draw them away from areas where the use has been too heavy, where soils are apt to erode, where forage is easily killed, or where valuable trees may be damaged. To control grazing, change the salt stations frequently. There are places, however, where changing salt will not help. Livestock often cannot find salt placed in dense tall brush and thick stands of timber.

Livestock graze small pastures more evenly than large ones. Irregular or triangular areas usually are more difficult to graze uniformly than rectangular ones.

Large ranges where animals concentrate on some range sites more than others can be divided into small pastures. Then each area can be grazed separately and more uniformly. Often this need is temporary and cheap fences will serve. Use electric fences where boundaries need to be shifted frequently.

Many ranchmen change their fences to give livestock a wider pasture in the path of prevailing winds. This brings about a more uniform use of grass. Animals in the southwest graze into the wind. Thus the windward side of the pasture is grazed the most.

Sometimes your ranges are so mixed up with mountains, canyons, and rolling uplands that it is impossible to manage them so that all range sites are held in excellent or even good condition. Your goal should be the highest range condition feasible for the site which contributes most to your net income. At the same time, you should guard against damage to other range sites that have to remain in lower condition.

Give Grassland Occasional Rests

Where the range condition and the vigor of vegetation are low, both can be improved by well-timed rests. The best time to rest plants depends on how they grow and when they develop seed.

In general, cool-season grasses low in vigor need to be rested in spring and early summer; warm-season grasses in summer and early fall. Where both cool- and warm-season grasses are in the same pasture, rests should last from early spring to late fall to benefit both kinds of plants. Generally moderate winter grazing of summer-rested pastures is beneficial.

Rests during the growing season allow plants to produce seed and reproduce by rootstalks and stolons. Germination and growth of seedlings are higher on ranges rested for 2 or more years; spread of plants by vegetative parts also is better.

Obviously, it is usually impracticable to keep livestock out of all the pastures while the grass grows. But you can rest some of them while others are grazed. Finally, over a period of years, all pastures benefit from growing-season rests. As the better plants increase in number and abundance, their vigor improves and their yield is greater.

The pastures being grazed must not

be overused while the others are rested or you will lose the benefits. Where summer grazing is moderate, seedlings and new sprouts from buds of older plants have a better chance to become vigorous forage producers.

Keep all livestock out of the pastures being rested. A few animals left in a pasture will eat the seedstalks of the better grasses, and leave the poor kinds to increase. In the late summer and early fall the tender seedstalks are more succulent than the leaves and stems. Where seed is needed to thicken the stand, don't graze the pasture at flowering and seeding time.

On arid and semiarid ranges, short rests ordinarily do not help much, if the rate of stocking remains the same. But there are times when you can shift animals between pastures to advantage. For example, shift cattle from ranges when oak or other seasonally injurious plants are dangerous.

It may be helpful to shift them to succulent annuals or low-grade perennials when the good perennials are dormant. It is also beneficial to rotate tame pastures that are to produce both grazing and seed or hay.

Rotating animals between pastures with annual grass and those with native perennial grass is a good practice where farming and grazing are carried on together. Rotation between seeded and native grass pastures is also proving useful.

Often the type of vegetation makes it desirable to graze some pastures in winter and others in summer. For example, summer gains per animal are about the same for both tobosa and grama grass. But tobosa does not make as good winter grazing as grama grass. Therefore, summer grazing of tobosa and winter grazing of grama make a good combination.

On ranches having both kinds, it is profitable to graze cool-season pastures in winter and warm-season ones in summer. Ranges with four-wing-saltbush, guajillo, or other evergreen shrubs high in protein can also be used for winter grazing.

Rough or tree-sheltered grazing land is good for winter use. Insects are worse in summer where trees are abundant.

Some shifting between pastures is needed to help with livestock management, as in breeding, calving and lambing, branding, dehorning, and other operations. Many operators maintain several pastures to hold different classes of animals, such as bulls, cows, stockers, etc. Ordinarily you don't need extra fencing to practice the type of rotation grazing that goes naturally with these operations.

Use Feeds To Supplement Grass

Livestock select range or pasture forage as it develops in natural sequence throughout the year. Most livestock, however, at some time suffer from hunger. Hunger may be due to feed shortages, or it may be due to poor forage.

It pays to use farm-grown or commercial feeds at certain times. Each year, you may need them when forage growth is at a low or when pastures need to be rested.

In bad years most ranchmen need feed reserves. These are emergency supplies. Their purpose is not to supply feed for more livestock, but to maintain the herd when there is little range forage.

Concentrates, on the other hand, are not for emergencies. They are supplemental feeds to supply protein, minerals, and vitamins not in the range forage. They should not be used to increase range use to the detriment of perennial plants.

Pioneering Americans used grass as their first hay crop. Good grass hay is one of the better roughages for cattle, sheep, and horses. Supplies of it, or other roughages, need to be kept on hand for feed reserves.

Tall and mid grasses yield more hay than short grass. Hence meadow management should be directed toward keeping the taller grasses. Bluestem meadows mowed about 6 inches high and cut before seed maturity yield

more hay than those cut short after seed maturity. Hay production may be increased 20 percent or more by mowing the grass at the right height and at the right time.

Renovate Short-Grass Ranges

On the High Plains, short-grass ranges present special management problems. They generally absorb less moisture, lose more water from runoff and evaporation, and produce less grass and beef than ranges made up of a mixture of mid and short grasses.

The short grasses also lose much forage by shattering from wind action after the grasses mature. In addition, the loss from shattering and trampling by grazing animals sometimes runs as high as 40 percent on short-grass ranges. The fact that the short grasses generally are more brittle when dry than mid and tall grasses, reduces their value for both forage and soil conservation.

Although sound grazing practices can improve most rundown rangeland, renovation may hurry it. One way is by pitting (see p. 18). This was demonstrated by the Dryland experiment station, the Soil Conservation Service, and the University of Wyoming on the Archer Field Station near Cheyenne, Wyo.

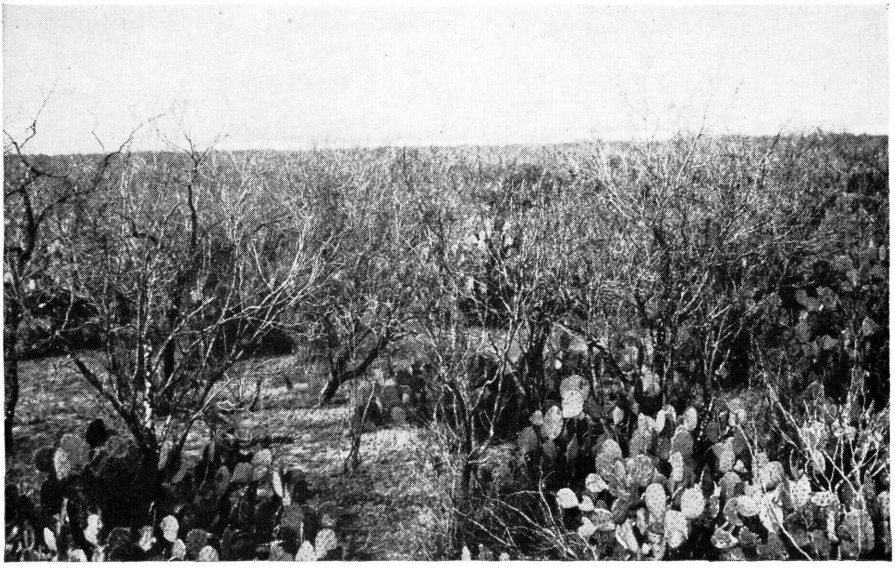
Blue grama and buffalograss ranges were renovated with a pitting machine. The treatment benefited the range by thinning out the sod-bound short grasses. The cultivation stimulated the growth of the short grasses—not the number of plants—and encouraged reestablishment of western wheatgrass and needle-and-thread. Both of these are cool-season grasses and yield more than short grasses. The pitting also increased the land's ability to absorb rainfall.

For 6 years the pitted pastures produced 30 percent more lamb gain per acre than the untreated ones, and the amount of unused grass was greater at the end of each grazing season.

Pitting is particularly advantageous on hard-packed, low-vigor, short-grass ranges.

Remove Woody Vegetation

Mesquite and other shrubs are taking over much rangeland in Oklahoma and Texas. In 1952 about



Both brush removal and moderate grazing are needed before ranges like this one can improve.

This 2-year-old seeding of native bluestems, blue grama, side-oats grama, and buffalograss has made idle land productive.

112 million acres were infested. This invasion has taken place since the introduction of domestic livestock and is a result of the decline in range condition. As the taller grasses go out under heavy use, they are replaced by short grasses and weeds that are unable to prevent the mesquite invasion.

These changes are slower under some soil conditions. Mesquite requires a lot of water. On the droughty, well-drained, limestone soils of the Fort Worth Prairie, the mesquite invasion is slow and the trees are stunted even if the range is in only fair condition.

Once established, however, many of the invading species are too deep-rooted to be forced out by grass competition. Mechanical or chemical methods must be used.

Tree-dozing, brush cutting, cabling, and deep plowing have all given good results when correctly used. Original costs run from $5 to $15 per acre for tree-dozing, $4 to $5 per acre for brush cutting, $1 to $4 per acre for cabling, and $10 to $20 per acre for deep plowing. Benefits are short-lived unless followed up by controlling sprouts and seedlings. On the better range sites, both seedlings and sprouts usually return quickly. A good stand of vigorous climax grasses, however, will hold them back. Sprout control with rolling types of brush-cutting maintainers costs from 25¢ to $1 per acre per year.

Of the chemical controls, kerosene was the first to be widely used. Costs run from $7 to $16 per acre. In many places, 90 percent of the treated trees have died but poorer results are more common. Sand sagebrush can be killed with 2,4–D at a cost of $2 per acre. Extensive trials of this chemical and 2,4–5T are underway on mesquite and other brush.

The increased production of grass following the removal of brush varies considerably with the range site and range condition. On sandy land sagebrush removal increases yields from 25 to 100 percent. On ranges of the Rolling Red Plains in fair condition, mesquite removal has increased annual grass production up to 15 percent.

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